Appl. No. : **10/608,233**
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AMENDMENTS TO THE CLAIMS

Listing of Claims:

1. (previously presented): A chirped pulse amplification system comprising, a low group delay ripple nonlinearly chirped fiber Bragg grating pulse stretcher system, said pulse stretcher system producing stretched pulses longer than 300 ps; at least one fiber amplifier following said pulse stretcher system; and a pulse compressor5 for compressing said stretched pulses by more than a factor of 50, producing compressed pulses having a bandwidth greater than 1 nm.

2. (previously presented): A chirped pulse amplification system comprising, a low group delay ripple nonlinearly chirped fiber Bragg grating pulse stretcher system, said pulse stretcher system producing stretched pulses longer than 1 ns; at least one fiber amplifier following said pulse stretcher system; and a pulse compressor for compressing said stretched pulses by more than a factor of 150, producing compressed pulses having a bandwidth greater than 1 nm.

3. (previously presented): A chirped amplification system comprising, a low group delay ripple nonlinearly chirped fiber Bragg grating pulse stretcher system, said pulse stretcher system producing stretched pulses longer than 100 ps; at least one fiber amplifier following said pulse stretcher system; and a pulse compressor for compressing said stretched pulses by more than a factor of 50, said compressed pulses having a bandwidth greater than 1 nm.

4. (previously presented): A chirped pulse amplification system comprising, a low group delay ripple nonlinearly chirped fiber Bragg grating pulse stretcher system, said pulse stretcher system producing stretched pulses longer than 100 ps; at least one diode laser amplifier, parametric amplifier, Raman amplifier or combination thereof following said pulse stretcher

system; and a pulse compressor for compressing said stretched pulses by more than a factor of 50, said compressed pulses having a bandwidth greater than 1 nm.

5. (previously presented): A chirped pulse amplification system as in claim 3, whercin said pulse stretcher system includes plural concatenated fiber Bragg grating stretchers.

6. (original): A chirped pulse amplification system as in claim 3, wherein said pulse compressor comprises at least one fiber Bragg grating compressor and a bulk grating compressor.

7. (original): A chirped pulse amplification system as in claim 3, wherein optimally compressed pulses are obtained at a target downstream from said pulse compressor, where the optical beam-path between said pulse compressor and said target further contains additional optical elements other than air.

8. (original): A chirped pulse amplification system as in claim 7, wherein said additional optical elements comprise optical beam delivery fibers.

9. (previously presented): A chirped pulse amplification system as in claim 8, wherein said delivery fibers comprise one of a single-mode fiber, a multi-mode fiber operated with a single-mode output, a holey fiber, a photonic crystal fiber, or a fiber with a guiding air-hole core.

10. (previously presented): A chirped pulse amplification system, comprising; a seed pulse source producing short optical pulses with a spectral bandwidth greater than 1 nm; a nonlinearly chirped fiber Bragg grating pulse stretcher, said pulse stretcher exhibiting a group delay ripple of less than 10 ps within the spectral bandwidth of said seed pulse source; an amplifier following said pulse stretcher; and a compressor for recompressing stretched pulses.

11. (previously presented): An optical combination, comprising; a seed pulse source producing optical pulses with a spectral bandwidth greater than 1 nm; a nonlinearly chirped fiber

Bragg grating pulse stretcher system, said pulse stretcher system exhibiting a group delay ripple of less than 10 ps within the spectral bandwidth of said seed pulse source; and an amplifier following said pulse stretcher system.

12. (canceled).

13. (canceled).

14. (canceled).

15. (previously presented): A chirped pulse amplification system, comprising; a seed pulse source producing short optical pulses; a stretcher for stretching said pulses; a plurality of concatenated sections of predominantly polarization maintaining fiber, at least one of which is also an amplifier; and at least one polarizer inserted between any two sections of said predominantly polarization maintaining fiber.

16. (canceled).

17. (canceled).

18. (previously presented): A polarization maintaining air-clad fiber, where polarization maintaining operation of said fiber is obtained by the incorporation of stress producing regions into said fiber.

19. (previously presented): A polarization maintaining air-clad fiber as claimed in claim 18, wherein said fiber comprises additional cladding regions.

20. (canceled).

21. (canceled).

22. (canceled).

23. (canceled).

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24. (previously presented): A chirped pulse amplification system comprising, at least one low group delay ripple nonlinearly chirped fiber Bragg grating pulse stretcher producing stretched pulses; at least one fiber amplifier following said pulse stretcher; and a pulse compressor for compressing said stretched pulses, producing compressed pulses having an energy greater than 100 nJ and a bandwidth greater than 1 nm.

25. (previously presented): A system as claimed in claim 24 wherein said pulse compressor includes at least one chirped fiber Bragg grating and a bulk grating.

26. (previously presented): A system as claimed in claim 24 wherein said pulse compressor comprises a holey or photonic bandgap fiber.

27. (previously presented): A system as claimed in claim 26 wherein the holey or photonic bandgap fiber is engineered to perform complete pulse compression or partial pulse compression.

28. (previously presented): A system as claimed in claim 27, wherein the holey or photonic bandgap fiber which performs complete or partial pulse compression also acts as power delivery fiber.

29. (previously presented): A chirped pulse amplification system, including a short pulse seed source, a fiber grating pulse stretcher, an adaptive pulse shaper, at least one amplifier and a pulse compressor.

30. (previously presented): A chirped pulse amplification system according to claim 29, where said at least one amplifier is one of a fiber, Raman, parametric, solid-state or diode amplifier.

31. (previously presented): A chirped pulse amplification system according to claim 29, where said adaptive pulse shaper is an adaptive fiber grating based pulse shaper.

32. (previously presented): A chirped pulse amplification system according to claim 29, where said fiber grating pulse stretcher and said adaptive pulse shaper are combined into one integrated fiber grating pulse shaping device.

33. (previously presented): A chirped pulse amplification system according to claim 32, where adaptive pulse shaping in said pulse shaping device is enabled via modifying a refractive index of at least one selectable portion of said pulse shaping device by controlling a temperature of said selectable portion.

34. (previously presented): A chirped pulse amplification system according to claim 32, where adaptive pulse shaping in said pulse shaping device is enabled via modifying a refractive index of at least one selectable portion of said pulse shaping device by controlling an internal stress within said selectable portion.

35. (previously presented): A chirped pulse amplification system as claimed in claim 33 wherein a number of said selectable portions is in a range between 4 and 4000.

36. (previously presented): A chirped pulse amplification system as claimed in claim 34 wherein a number of said selectable portions is in a range between 4 and 4000.

37. (previously presented): A chirped pulse amplification system as claimed in claim 35, wherein a number of said selectable portions is in a range between 4 and 400.

38. (previously presented): A chirped pulse amplification system as claimed in claim 36 wherein a number of said selectable portions is in a range between 4 and 400.

39. (previously presented): A chirped pulse amplification system comprising, a low group delay ripple nonlinearly chirped fiber Bragg grating pulse stretcher, said pulse stretcher producing stretched pulses longer than 1 ns; at least one fiber amplifier following said pulse stretcher; and a pulse compressor for compressing said stretched pulses by more than a factor of

50, producing compressed pulses having an energy greater than 1 μJ (1 micro J) and a bandwidth greater than 1 nm.

40. (previously presented): A chirped pulse amplification system comprising, a low group delay ripple nonlinearly chirped fiber Bragg grating pulse stretcher; at least one fiber amplifier following said pulse stretcher and having a substantially step index profile; and a pulse compressor for compressing stretched pulses, producing compressed pulses having a bandwidth greater than 1 nm.

41. (previously presented): A chirped pulse amplification system according to claim 3, further comprising an adaptively controlled pulse shaper located up-stream of said at least one fiber amplifier, in order to pre-compensate for self-phase modulation in said at least one fiber amplifier.

42. (canceled).

43. (canceled).

44. (previously presented): A chirped pulse amplification system comprising, a fiber Bragg grating pulse stretcher, said pulse stretcher producing stretched pulses or pulse trains with a prescribed, but freely selectable amplitude and phase profile, at least one amplifier following said pulse stretcher, and a pulse compressor for compressing said stretched pulses, thereby producing output pulses or output pulse trains with a freely selectable amplitude profile.

45. (previously presented): A chirped pulse amplification system according to claim 44, where said freely selectable amplitude profile is produced at a target material, the optical beam path between a bulk compressor and said target material further containing optical material other than air, comprising bulk optical materials and/or optical delivery fibers.

46. (previously presented): A chirped pulse amplification system according to claim 44, where said output pulses or output pulse trains are used for micro-structuring or micro-machining of a target material and where said freely selectable amplitude profile is optimized for the micro-structuring properties of said target material.

47. (previously presented): A chirped pulse amplification system according to claim 44, where said freely selectable amplitude profile generated by said pulse stretcher is used to counteract gain-narrowing in said at least one amplifier down-stream from said pulse stretcher, such that the amplified pulse width after compression in said pulse compressor is minimized.

48. (previously presented): A chirped pulse amplification system, comprising, a fiber Bragg grating pulse stretcher system including a plurality of fiber Bragg gratings, each of which is designed to stretch a separate spectral component of an input pulse; at least one amplifier following said pulse stretcher system, and a pulse compressor system for compressing and reconstructing stretched pulses by incoherent addition.

49. (previously presented): A system as claimed in claim 48 wherein said pulse compressor system comprises a series of bulk compressors spaced so as to temporally reconstruct said input pulse.

50. (previously presented): A system as claimed in claim 48 wherein said pulse compressor system comprises one or more bulk compressors spaced so as to output temporally separated portions of said input pulses.

51. (previously presented): A chirped pulse amplification system comprising, a nonlinearly chirped fiber Bragg grating pulse stretcher system, said pulse stretcher system producing stretched pulses longer than 100 ps and including plural concatenated fiber Bragg

grating stretchers; at least one amplifier following said pulse stretcher system; and a pulse compressor for compressing said stretched pulses by more than a factor of 50.

52. (previously presented): A chirped pulse amplification system comprising, a nonlinearly chirped fiber Bragg grating pulse stretcher system, said pulse stretcher system producing stretched pulses longer than 100 ps; at least one amplifier following said pulse stretcher system; and a pulse compressor for compressing said stretched pulses by more than a factor of 50, wherein optimally compressed pulses are obtained at a target downstream from said pulse compressor, where the optical beam-path between said pulse compressor and said target further contains additional optical elements other than air.

53. (previously presented): A chirped pulse amplification system comprising, a nonlinearly chirped fiber Bragg grating pulse stretcher system, said pulse stretcher system producing stretched pulses longer than 100 ps; at least one amplifier following said pulse stretcher system; a pulse compressor for compressing said stretched pulses by more than a factor of 50; and an adaptively controlled pulse shaper located up-stream of said at least one amplifier, in order to pre-compensate for self-phase modulation in said at least one amplifier.

54. (previously presented): A chirped pulse amplification system comprising, a nonlinearly chirped fiber Bragg grating pulse stretcher system, said fiber Bragg grating pulse stretcher system producing stretched pulses longer than 100 ps; at least one fiber amplifier following said pulse stretcher system; and a pulse compressor for compressing said stretched pulses by more than a factor of 50, said compressed pulses having a bandwidth greater than 1 nm.

55. (canceled).

56. (previously presented): A polarization maintaining fiber, comprising:

a fiber core having a diameter > 15μm;

a first cladding surrounding said core; and further including stress-producing regions incorporated therein;

an air cladding at least substantially surrounding

said first cladding; and

a third cladding surrounding said air cladding.

57. (New) A polarization maintaining optical fiber comprising:

a fiber core;

a cladding region disposed about said core, said cladding region comprising a plurality of features disposed therein, said plurality of features forming an optical cladding for said core; and

a plurality of stress producing regions that induce birefingence in said fiber thereby producing polarization maintaining operation.

58. (New) The optical fiber of Claim 57, wherein said plurality of features comprise a plurality of holes.

59. (New) The optical fiber of Claim 57, wherein said plurality of features comprise a plurality of air-holes.

60. (New) The optical fiber of Claim 57, wherein said stress producing regions are disposed about said core and said cladding region is disposed about said stress producing regions and said core.

61. (New) The optical fiber of Claim 57, wherein said plurality of stress producing regions comprise a pair of stress producing regions disposed on opposite sides of said core.

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62. (New) A polarization maintaining optical fiber comprising:

a fiber core;

a plurality of regions disposed about said core, said regions forming an optical cladding for said core; and

a plurality of stress producing regions that induce birefingence in said fiber thereby producing polarization maintaining operation.

63. (New) The optical fiber of Claim 62, wherein said plurality of features comprise a plurality of holes.

64. (New) The optical fiber of Claim 62, wherein said plurality of features comprise a plurality of air-holes.

65. (New) The optical fiber of Claim 62, wherein said stress producing regions are disposed about said core and said cladding region is disposed about said stress producing regions and said core.

66. (New) The optical fiber of Claim 62, wherein said plurality of stress producing regions comprise a pair of stress producing regions disposed on opposite sides of said core.